

## Lesson 1 – Learning From Animals

These lessons were developed in collaboration with the Pennsylvania Society for Biomedical Research (PSBR). For additional information about animal research and PSBR programming, visit [www.psbr.org](http://www.psbr.org).

### LESSON QUESTIONS

- What are the benefits of studying and understanding other species?
- How has animal research improved our understanding of disease?

### LESSON OBJECTIVES

- Summarize why studying and understanding different species can improve human health.
- Compare examples of how knowledge gained from animals has helped further our understanding of human disease.

**DOK 2 - 4**

### OVERVIEW

Animal research and vaccines have contributed significantly to human health and continue to do so. This lesson provides students with the foundation for understanding why different species of animals help scientists to develop new drugs, treatments and vaccines.

### LENGTH

Two 45-minute sessions

### GLOSSARY TERMS

bioethics; clinical trial; compliance; Federal Food, Drug, and Cosmetic Act; sulfanilamide; three Rs

### STANDARDS

- **Next Generation Science Standards**
  - HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
  - HS-LS1-2.2.1 Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.

- HS-LS1-2.4.1 Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales.
- HS-LS1-2.LS1.A.1 Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
- HS-LS4-6.LS4.D: Biodiversity and Humans – Humans depend on the living world for the resources and other benefits provided by biodiversity.

- **Common Core State Standards**

- RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
- RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.
- WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
- HSS.IC.A Understand and evaluate random processes underlying statistical experiments.
- HSS.IC.B Make inferences and justify conclusions from sample surveys, experiments, and observational studies.
- HSS.ID.A Summarize, represent, and interpret data on a single count or measurement variable.

## MATERIALS

- Computer with internet access
- Writing tools (pen, colored markers, etc.)
- Sticky notes

## BACKGROUND FOR TEACHER

In this lesson, students learn about the role of animals in furthering the pursuit of human knowledge. Humans have depended on animals since prehistory. Since the dawn of civilization, we have used animals for food, transport, protection, and companionship. The early Greeks understood our similarities with animals. Aristotle and Galen performed animal experiments. In the 12th century, the Arab physician Ibn Zuhr tested surgical procedures on animals before operating on human patients. In the late 1800s, Darwinian evolution highlighted our intimate relationship with animals. Today, we understand that humans and animals share many traits, beginning at the genetic level. These shared features have led to significant advances in human medicine. This lesson provides a foundation for students to explain how and why animal research improves human health and well-being. The lesson provides a learning pathway for students to explore different ways in which animal research has contributed to medical advances. Students will learn how animal research has helped scientists to develop many modern drugs and surgical techniques. With these advances, modern medicine can save lives, extend lifespans and reduce human suffering.

## TEACHER NOTES

Some students may be sensitive regarding the use of animals for biomedical research. Explain that there is a lot of misinformation online and that the aim of this lesson is to objectively examine the costs and benefits of using animals for biomedical research. The overall goal is for the student to have enough authoritative information to determine whether the benefits of using animals for biomedical research outweigh the costs. After the Explore section, you may wish to present background information to clarify student thinking on this topic. Consider summarizing information from the Lesson Resources to guide your presentation.

## LESSON RESOURCES

- Lesson video
  - *How are Animals Essential to Research?* <https://vimeo.com/24545830>
- “Taste of Raspberries, Taste of Death: The 1937 Elixir Sulfanilamide Disaster”, Carol Ballentine, FDA Consumer magazine June 1981 Issue.  
<https://www.fda.gov/downloads/AboutFDA/WhatWeDo/History/ProductRegulation/UCM593517.pdf>

- Other resources that may be helpful:
  - Animal Research/Medical Benefits, Pennsylvania Society for Biomedical Research, <http://www.psbr.org/animal-research/medical-benefits>
  - Hajar, R. (2011) Animal Testing and Medicine. Heart Views. 12(1): 42. doi: <http://www.heartviews.org/article.asp?issn=1995-705X;year=2011;volume=12;issue=1;spage=42;epage=42;aulast=Hajar>
  - Biomedical Research with Animal Models (PDF), California Biomedical Research Association, <http://ca-biomed.org/wp-content/uploads/2018/02/FS-WhyAnimalModels.pdf>
  - Benefits of Animal Research, American Association for Laboratory Animal Science Foundation, [https://www.aalasfoundation.org/outreach/About-Animal-Research/benefits\\_to\\_people\\_and\\_animals](https://www.aalasfoundation.org/outreach/About-Animal-Research/benefits_to_people_and_animals)
  - Alternative Table Texting Strategy (PDF), <http://www.lakemills.k12.wi.us/faculty/RMitchel/workshop/socailmediatemplates/TableTexting.pdf>

## ENGAGE

1. Ask students to write five ways in which they have benefitted from animals in the past week. If needed guide students with ideas or suggestions such as use of animals for food (e.g., meat and dairy), clothing (leather), or companionship (pets).
2. Students work in small groups to pool their information and summarize ways in which humans benefit from animals.
3. Ask students to determine if any of their listed benefits included animals used for biomedical research. If necessary, guide students to understand that animal research has led to significant advances in the medical sciences.
4. Write a higher level thinking open-ended question related to animal research. (e.g., “Why are animals necessary for biomedical research?”)
5. Students watch the video, *How are Animals Essential to Research?*
6. Use a Table Texting strategy to reinforce learning from the video:
  - i. Instruct students not to take notes.
  - ii. Pause the video after each point, where you feel is most appropriate.
  - iii. At each pause, students pretend to text their neighbor. They write down a point from the content and then ask their own question.
  - iv. They can use sticky notes to write their “texts.” (Using real devices may be distracting.)
  - v. Give students one minute for writing before they pass their notes to a neighbor.
  - vi. Continue the video, and again pause where appropriate, repeating the texting exercise until the video is complete.

7. Students share their statements and questions with the class. You may wish to place the sticky notes on the board. Students can then categorize the statements and questions.
8. Explain to students that they will investigate the role of animals for enabling advances in biomedical research.

### EXPLORE

1. Students research online to address the key concept for the lesson: study and knowledge of non-human species has improved our understanding, treatment and prevention of disease.
2. Students read the article “Taste of Raspberries, Taste of Death: The 1937 Elixir Sulfanilamide Disaster” (listed in Resources). Use this as an example of the need for using animals in biomedical research. Encourage students to explore online for additional examples.
3. Allow students to work alone, in pairs, or in small groups. If needed, guide students to explore specific concepts by addressing questions such as:
  - What has been the historical role of animals in biomedical research?
  - How do genetic and physiological similarities between humans and other animals help scientists learn how to treat and prevent diseases?
  - What are possible consequences of not using animal models in biomedical research?
  - Why are some animal species preferable to others for carrying out biomedical research?

### EXPLAIN

1. Review glossary terms that students may have encountered in their research. If needed introduce them to the lesson glossary terms.
2. The student groups use their findings from Explore to organize information related to the questions they are answering.
3. Allow groups to choose their own approach for explaining the answers to the questions they researched. If needed, guide struggling students by suggesting how to organize their information. Each group chooses one of the following approaches:
  - Create a timeline to illustrate advances in medicine due to use of animals in biomedical research.
  - Create a concept map to relate genetic and physiological similarities between humans and other animals to treatment and prevention of disease.
  - Write a short essay citing evidence to illustrate possible consequences of not using animal models in biomedical research.

- Use a graphic organizer or presentation format to compare animal species for suitability in biomedical research (e.g., comparison between fruit flies, zebrafish and mice).
4. When groups have completed their assignment, they present their results to the class. Students should include an explanation of why their approach was an appropriate way to organize the information.

### ELABORATE

1. If time allows, students can further investigate the role of animals in biomedical research. Possible options include:
  - Exploring careers in biomedical research that would involve animals.
  - Identifying interdisciplinary approaches that relate to the use of animals in biomedical research.
  - Categorizing different species of animals according to the types of research for which they are most suited.

### EVALUATE

1. Students exchange the materials they created in Explain with other students.
2. Students constructively critique each other's work, providing suggestions for improvement.
3. Students take the summative assessment quiz.

### EXTENSION

As an extension activity, particularly if there are students who still feel strongly against animal research, students can work in small groups to explore and explain examples where advancements in biomedical science have reduced or eliminated the need for animals in research.

### RUBRIC: STUDENT WORKSHEET Summative Assessment Quiz

1. In which period of history was the earliest documented animal research performed?
  - D. Ancient Greece
2. What is the primary purpose of animal research?
  - B. Use animal models to test scientific hypotheses

3. Which scientist used animal research to develop a vaccine for rabies?

- C. Louis Pasteur

4. What is the primary area of research for which the fruit fly (*Drosophila melanogaster*) is used?

- A. Genetics

5. Which animal would be most appropriate for investigating possible adverse reactions to a new vaccine that prevents a human disease?

- B. Mouse

6. Correctly completed passage:

One animal that has provided significant advances in biomedical research is the chicken. For example, the scientist Louis Pasteur created a vaccine by inoculating chickens with cholera bacteria. The chicken egg is an ideal tool to investigate the biology of cancer. The embryo naturally lacks a strong immune system. This enables researchers to implant both normal and cancer tissues in the membrane underlying the eggshell. In this way, scientists can compare experimental and control treatments to investigate the growth of tumors.

7. Correct order of steps to provide a safe formulation of the drug:

Step 1 - E. Determine that diethylene glycol is a solvent for sulfanilamide

Step 2 - B. Research suitable flavorings

Step 3 - C. Test for flavor, appearance, and fragrance

Step 4 - A. Conduct animal tests for toxicity

Step 5 - D. Review results and refine new formulation

Step 6 - F. Compound the formulation for shipping

8. Write a short passage citing evidence (with at least one example) of why animal testing is a necessary part of biomedical research.

- Answers may vary. Sample answer: Nearly all vaccines available today are the result of animal research. For example, the polio vaccine was developed through animal research. The first evidence of the polio virus came when researchers took material from the spinal cord of a boy who died from the disease. Extracts of this material caused polio in the monkey test animals. Today, because of this and other research, polio has been almost eradicated.